



# An investigation of rural infrastructural resources and sustainable rural expansion in India

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## General Note



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## ABSTRACT

Rural infrastructural resources are crucial for agriculture, agro-industries and overall economic development of rural areas such as, credit absorbing capacity, enhancing the productivity of crops and livestock, generating employment, increasing farmers' income, etc. and it makes a direct attack on minimizing the incidence of rural poverty. Rural development mainly depends on the existing infrastructural resources for all existing sectors for social, economic and cultural development of rural masses. India has a wide range of infrastructural resources devoted to nation's development, in the form of road and transport, electricity, postal and telecommunication, education, health and sanitation, drinking water facilities, etc. In this context, the present paper is intended to conduct status analysis on the rural infrastructural resources in India and the need for their modernization for sustainable rural development. It also highlights the recent scenario on the rural infrastructural resources and their potentialities to the development of various rural sectors in India, which include agriculture, rural industries, banking and all other essential sectors of social and economic development of India. It is therefore concluded that the rural infrastructural resources are the backbone of the sustainable development of various rural sectors of our country.

**Keywords:** rural development, infra-structural resources; sustainability

## 1. INTRODUCTION

Rural infra-structural resources are incidentally providing basic amenities that improve the quality of life. There are often good reasons for public sector involvement in the provision of rural infrastructure resources. However, in the production of such services there exists a role of people's participation and in the process; it makes a direct attack on minimizing the incidence of rural poverty. This challenge can be only with a well conceived perspective plan on rural infrastructure development towards betterment in rural area.

## 2. OBJECTIVES

Based on the background, the present study intended to conduct a status analysis on the rural infrastructural resources in India and the need for their modernization for sustainable rural development. The objectives are

- 2.1. To trace out the current status of rural infrastructural resources in India
- 2.2. To analyse the role rural infrastructural resources in sustainable rural development
- 2.3. To develop a model for the promotion and development of rural infrastructural resources towards sustainable rural development

## 3. METHODOLOGY AND REVIEW OF LITERATURE

The present research work is mainly based on the secondary sources of data collected at National level through consulting various institutions and libraries, particularly, National Institute of Rural Development & Panchayat Raj (NIRD&PR), Hyderabad, Ministry of Rural Development (GOI) and so on. The required data have been collected to fulfill the requirements of the present research work. The collected literature has been scrutinized and reviewed carefully. It is important to record select reviews which provide a comprehensive support to the present work. Elmondorf and Merrill (2007) found that there has been evidence on the link between poverty alleviation through infrastructural resources. Especially, rural infrastructural resources lead to an increase crop income among small farmers. It has been observed that there is relationship between increase in acreage of crop cultivation and the standard of rural roads, transport and distance from commercial crops. Binswanger and Feder (2003) argued that investments in rural infrastructural resources make lowered transportation cost, increased farmers' access to markets and lead to substantial agricultural expansion which leads to sustainable crop production. Verma (2009) extends their results that rural infrastructural resources contribute directly and chiefly to a substantial reduction in rural poverty through the generation of employment opportunities in agricultural and allied activities, higher wages and increases in the production of various rural sectors. Arvind and Rakesh (2006) concluded that spatial data infrastructure envisioned National information infrastructure which provides the means to get current and accurate geospatial data contributing locally, nationally and globally leading to better economic growth, environmental quality and stability. Saikia and Adhyapok (2011) found that the availability of irrigation facility is undoubtedly the most important prerequisite in the development in rural economy of India. Mukherjee (2012) states that the rural tourism in India is an alternate source of livelihood and employment for rural masses. The majority studies provide that rural infrastructural resources are the essential ingredients to national development but there is an urgent need to upgrade and modernize them which will provide fruitful benefits to the livelihoods of rural people.

## 4. ROLE OF RURAL INFRASTRUCTURAL RESOURCES IN SUSTAINABLE RURAL DEVELOPMENT

Adequate infrastructural resources raise productivity and preconditions for economic development practically required everywhere and investments in essential Overhead capital is advocated. The invisibility in the social overhead capital has been identified as one of the main obstacles of the development of underdeveloped countries. The First Five Year Plan recognized that large areas of the country have remained underdeveloped due to lack of basic requirements like transportation, communication, energy and water management. The plans continued to emphasise the infrastructure development, there were no matching financial outlays for these sectors. Small townships were considered to make the process of urbanization more compatible with the overall economic development pattern and environmentally less damaging. The development of physical infrastructure, the plan also recognized that social infrastructure is to be attended to with a degree of urgency in the next phase of development. The stock of infrastructure has expanded manifold in the country in the 46 years of planned development. The electric power generation increased almost 75 times from 5.1 billion kWh in 1950 - 51 to about 380 million kWh in 1995 - 96. Fertiliser production in the country has increased from 0.50 lakh tones to over 117 lakh tones, whereas irrigational facilities increased from 22.50 million hectare to 70.25 million hectare during the same period of 1950-51 to 1995-96. These are three important physical infrastructural resources significantly influencing

production and growth in agriculture. Similarly the number of regulated markets in the country increased from 206 to 6,836 during the same period.

States with predominant deficiency in infrastructure in four prominent sectors are indicated in Table 1.

**Table 1**

State wise Index of Rural Infrastructural Resources, Yield of Foodgrains and Value of Production per Hectare

Sl. No.	State	Index of Infrastructure	Yield of Foodgrains per Hectare (Kg)	Value of Output per Hectare (Rs.)
1.	Andhra Pradesh	53.6 (X)	1713 (VII)	4089 (XII)
2.	Assam	50.8(XI)	1308 (XI)	5402 (VIII)
3.	Bihar	42.0(XV)	1446 (X)	4091 (X)
4.	Gujarat	55.6 (VII)	1249 (XII)	2062 (XVII)
5.	Haryana	65.9(IV)	2730 (II)	7288 (IV)
6.	Himachal Pradesh	56.6(VI)	1643(VIII)	6797(V)
7.	Jammu &Kashmir	53.9(IX)	1632(IX)	6696(VI)

Source: Verma, et. al. (2009) Rural Infrastructure, Sarap and Sons, New Delhi.

The commercialization of infrastructural provision services, there has been bearing the responsibility of providing the adequate access to basic services such as health, education, water supply, sanitation and sewage.

As far as rural telephony is concerned, by December 2005, 5,39,572 villages were connected lining a Village Public Telephone (VPT). Under Bharat Nirman a total of 66,882 villages are to be provided by VPTs by the end of 2007. In rural areas more than 2 lakh public call offices (PCOs) and 14.18 million phones have been provided.

The Pradhan Mantri Gram Sadak Yojana (PMGSY) was launched in 2000 as a 100 percent central subsidy scheme to provide all-weather connectivity to all eligible unconnected in rural habitations. Bharat Nirman envisages connectivity by 2009 in all habitations with a population of 1000 or more in the plains and of 500 or more in the hilly, desert and tribal areas.

## 5. DISTRIBUTION OF RURAL INFRASTRUCTURE RESOURCES TO THE DEVELOPMENT OF VARIOUS RURAL SECTORS

This provides the detailed analysis of the role of rural infrastructural resources in sustainable rural development, in terms of agriculture development, animal husbandry, rural industries, rural tourism, banking and financial institution rural roads and transport, rural electrification, rural telecommunication and so on.

### 5.1. Agriculture Development

Agriculture contributes a share of about 14 percent to the State Income accommodating about 60 percent of the work force. Salient features of agriculture are characterized by production by the masses, in contrast to mass production by the industrial sector and seasonal variability. Agriculture sector has witnessed remarkable improvements over the last 50-year period. Green revolution in paddy, yellow revolution in oilseeds, white revolution in milk production, blue revolution in fish production and golden revolution in horticulture attest to the point that these are really land marks in the growth of agriculture and allied activities. The Green Revolution (1964-65), the Intensive Agricultural District Programme (1960-61), Intensive Agricultural Area Programme (1964-65), Small Farmers' Development Agency (1971), Food Corporation of India (1965), Commission for Agriculture and Prices (1965), Training and Visit Programme (1980-81), Tamil Nadu Agriculture Development Programme 1990-91, etc. are milestones in the history of agriculture. Extension services were helpful in sensitizing the farming community to the latest breakthrough in technological improvements. Packages of inputs such as seeds (High Yielding Varieties), fertilizer and pesticides were routed to the farmers at subsidized rate. These promotional measures made a tangible impact on the agriculture production and yield rates through time. Because of these achievements gained by the government, Tamil Nadu is at the top in food production.

### 5.2. Promotion of Activities of Animal Husbandry and Fisheries

During the last 50-year period 11 Quinquennial Censuses had been conducted in the State. A sinuous trend is being noticed in the growth of livestock population. As per the results of the Livestock Census, the livestock population was at 249 lakh in 1951. In 1956 it declined to 232 lakhs. In 1966 it was around 246 lakh in the State. It peaked at 264 lakhs in 1989. It declined to 249 lakhs in 2004.

Thus, livestock population shows a fluctuating trend over the last 11 Quinquennial Livestock periods. With respect to cattle it showed fluctuating trend up to 1982. Thereafter, it was on the decline. In 1951 cattle population stood at 102 lakhs. It declined to 91 lakhs in 2004. With respect to buffalo, it also witnessed an oscillating trend over 11 Livestock Censuses. Buffalo population was at 23 lakhs in 1951. It peaked up at 32 lakhs in 1982, but declined to 17 lakhs in 2004. Similar to cattle and buffalo, sheep and goat population also showed variability in growth. Sheep population declined from 79 lakhs in 1951 to 56 lakhs in 2004. However, the goat population showed improvement over the years despite variations found in their numbers in between. The goat population which stood at 40 lakhs in 1951 rose to 82 lakhs in 2004. The goats and sheep are bred for their wool as well as table purposes. The poultry population has been steadily increasing over the years. The poultry population which was 83 lakhs in 1951 increased to 866 lakhs in 2004.

### 5.3. Development of Rural Industries through Rural Infrastructure Resources

The overall RIIP increased from 114.5 in 1982 - 83 to 182.6 in 1992 - 93 with declaration noticed only in 1982 -83 and 1992 - 93. Group-wise, the Index of manufacturing went up from 123.8 in 1982 - 83 to 182.9 in 1992 - 93. In so far as the Manufacturing groups with larger weight experienced decline in 1983 -84 and 1992 - 93, the overall Index came down in sympathy with this. It shows that the manufacturing group yielded power to pull down the overall Index by virtue of having a relatively larger weight. The Index for electricity and mining rose from 73.5 to 177.4 and 103.7 to 193.4 respectively. The Index for electricity and mining fell once - 1983 - 84 for the former and 1986 - 87 for the latter. Growth rate of the industrial sector failed to achieve the plan target of 8 percent. It needs to be accelerated at a faster rate. In the 1990s the overall Index soared from 107.3 in 1994 - 95 to 125.5 in 2000 - 2001. During this 8-year period the index plummeted in 1997 - 98 and 1998 - 99 in correspondence with the decline in the manufacturing group whose index came down in 1997 - 98 and 1998 - 99. With respect to electricity group dips in its index was noticed in 1999 - 2000 and the mining group in 2000 -01 witnessed a steep fall of 20 percent.

**Table 2**

Index of Rural Industrial Production (RIIP) in Tamilnadu and India - Growth Rate

Period	Mining	Manufacturing	Electricity	General
<b>Tamil Nadu</b>				
1982-83 to 1992-93	6.4	5.9	6.3	5.8
1994-95 to 2000-01	5.1	3.2	6.0	3.4
The Noughties	0.8	2.9	4.1	3.0
<b>All - India</b>				
1982-83 to 1992-93	7.1	6.5	8.6	6.8
1994-95 to 2000-01	4.1	8.1	6.6	7.6
The Noughties	3.7	6.4	4.5	6.0

Source: Sankaran, K

In Tamil Nadu it shows the factor inputs are under-utilized because of sluggish growth in aggregate demand. Deceleration in growth of agricultural output tells upon the growth of industry because of downward trend in supply of inputs and demand for industrial goods. It emphasizes that capacity utilization is a necessary condition for accelerating the growth in industrial output and bridging the gap between the potential and actual industrial output. The industrial concerns should identify the gap in market for their products and devise production strategy accordingly.

### 5.4. Rural Infrastructural Resources for Development of Tourism

Tourism industry, an engine of economic growth, is an emerging one. Our economy is largely dependent upon tourism which creates employment opportunities, besides our largest source of foreign exchange. Tamil Nadu has the pride of having a large number of attractive tourist spots such as Ooty, Kodaikkanal, Courtalam, Pichavaram, Mudumalai, Thekkady, etc.

- India among the top 5 International destinations-Conde Nast Traveler's Readers' Award;
- India among the top 5 destinations according to Lonely Planet;
- Contribution of US\$4.8 million to the economy;
- Tourist arrivals crossed 3 million, creating immense direct and indirect employment;

- 55 villages selected for Rural Tourism-Gurukul concept introduced for the first time to popularize local art and craft;
- India promoted widely as a Medical and Cruise Tourism destination;
- Innovative scheme for sensitizing stakeholders 'Atithi Devo Bhavah' - Guest is God;
- Special focus on Jammu and Kashmir, North-East states and Andaman and Nicobar Islands; and
- Development of Buddhist Circuit in Uttar Pradesh as a World class destination.

The state is to tap the Nilgiris Mountain Railway to boost the volume of tourist traffic. A Nilgiris Mountain Odyssey is to be promoted so that the railways will become paying propositions.

### 5.5. Rural Infrastructural Resources for Banking & Financial Institution

The States are to fall in line with the national policy and take proactive measures both on demand and supply sides to control the prices of commodities of mass consumption and operate the Public Distribution System effectively to provide social safety net for the poor. Banking development in Tamil Nadu is assessed with the help of following variables such as distribution of banking network, deposit mobilization, credit disbursements, and credit deposit ratio. Following bank nationalization in 1969 banks have been performing mass banking as against class banking. Financial intermediaries do two district functions - mop up savings available with the individuals and channel them into productive investment. To make economic growth gather momentum, financial intermediaries are to take deeper root in rural, urban and semi-urban areas to resource development activities in a balanced manner. In 1980 - 81, there were 2811 scheduled commercial banks in Tamil Nadu. The number rose to 4282 in 1990 - 91 and further 4858 in 2004 - 05. The corresponding figures for urban areas were 980, 1316 and 1883, for semi-urban areas 845, 1043 and 1262 and for rural areas 986, 1923 and 1713. At the national level, number of banks branches tolled 68288. Rural areas had 31933 branches, semi urban areas 15421 branches and urban areas 20934 branches in 2004 - 05. All the above facts show that concentration of bank branches is urban - biased.

### 5.6. Rural Infrastructural Resources for Transport and Communications

Total vehicle population rose by leaps and bounds in Tamil Nadu as well as India. It rose from 0.19 lakh in 1950 - 51 to 46 lakh in 1999 - 2000. There is a close between urbanization and vehicle growth. The number of cars and three wheeler vehicles has led to tremendous growth as the cities expand. Out State is no exception to this trend. Two and three wheeler vehicles constituted 83.94 percent of vehicle population in the State during 2003 - 04. They increased to 56.68 lakh during 2003-04 from the previous year level of 50.74 lakhs. The registered motor vehicles in the State rose by 5.43 lakhs from 62.09 lakhs in 2002 - 03 to 67.52 lakhs in 2003 - 04 growth being 3.22 percent. Out of 67.52 lakh vehicles, commercial vehicles constituted 4.72 lakh numbers and the remaining 62.80 lakh noncommercial vehicles comprising 93.01 percent of the total. During 2003 - 04, the density of motor vehicles per sq. km was 52 and 10592 number of vehicles for per lakh population.

The Central Pollution Control Board (CPCB) is prevailing upon the vehicle owners to periodically check the vehicles for pollution emission and exhort them to use only unleaded petrol. Introduction of environment-friendly mode of transport is a right solution to air pollution. The Chennai Metropolitan Transport Corporation should ensure the road worthiness of all the vehicles frequently and withdraw the condemned and over aged vehicles off the road. With a view to reducing the incidence of air pollution, the proportion of alcohol blended with petrol should be 10 - 15 percent. Otherwise, the health of human beings, ecology and environment will suffer in alarming proportions. Steps required for resolving urban transportation problems are road development and redesign, transit development and motor traffic restrictions.

### 5.7. Rural Infrastructural Resources for Rural Electrification

Driven by the government's desire to enable universal access to electricity, the Ministry of Power has chalked out a blue print 'Mission 2012' which sets out milestones to be crossed in the coming 5 years. This exercise entails additional electrification of 62,000 villages by 2007, 18,000 remote villages by 2012, and complete electrification of all households by 2012. The Rajiv Gandhi Grameen Vidhyutikaran Yojana (RGGVY) was launched in April 2005 to complete household electrification within next five years' time and modernizing the rural electricity infrastructure. To achieve this objective, it is proposed that franchises like NGOs, consumer-associations and so on will be deployed with appropriate involvement of panchayat raj institutions. The State Governments will be free to provide appropriate targeted subsidy to poor households. Reliance Energy Ltd has taken up the massive task of electrifying 7220 UP villages as a part of the RGGVY. The company completed 50 percent of the task allotted to it by the Agro-based power discom Dakshinanchal Vidyut Vitran Nigam Ltd by May 2006. National Hydroelectric Power Corporation has also taken up rural electrification projects in West Bengal, Bihar, Jammu and Kashmir, Orissa and Chhattisgarh. It would implement rural electrification

projects in 1100 villages spread over twenty-seven districts of these five states. US Agency for International Development (USAID), in alliance with General Electrical (GE), has identified several villages in India for promoting rural electrification, using renewable energy technologies like biogas. For the rural electrification programme, the GE Global Research Centre in Bangalore has developed an integrated hybrid technology model.

### 5.8. Rural Infrastructural Resources towards Rural Roads and Transport

The rationale for public investment in rural roads is that households can exploit agricultural and non-agricultural opportunities to employ labour and capital more efficiently. The results of the empirical studies suggest that rural road investments reduce poverty significantly. Collateral advantages of rural roads lead to a higher rate of schooling for girls and boys. The rural road connectivity component of Bharat Nirman is to be achieved through PMGSY which is an ongoing programme.

### 5.9. Rural Infrastructural Resources for Rural Telecommunication

Currently, the rural tele-density stands at a meagerly 2 percent compared with urban tele-density of 31 percent. The TRAI has proposed a subsidy of Rs.8,000 crore for creating necessary infrastructure which will raise the tele-density in rural areas from the current 1.9 percent to 15 percent by 2007. With this kind of subsidy support, it will be possible to install 20,000 base stations in rural areas to cover about 80 - 90 percent of the villages. The government has amended the Indian Telegraph Act to include mobile services in rural areas under basic telephony. Cellular operators now will be able to access the USO (universal service obligation) fund to finance telecom infrastructure in rural areas. Besides, they will also get the government subsidy enjoyed by the basic telecom service providers in rural areas.

## 6. FUNDING FROM GOVERNMENT SOURCES, FOR THE MANAGEMENT OF RURAL INFRASTRUCTURAL RESOURCES

Around 70 percent of the population of India lives in rural areas, and therefore, Indian planning has a history of intervening in and focusing on the problems of the rural sector. It was around the mid-1970s that the concept of basic minimum needs came into the policy frame, with an explicit acknowledgement of the worsening rural poverty situation and large scale unemployment (Binswanger and Feder 2003). Through the Sixth Plan, the management of rural infrastructural resources through various levels in participation of local people set the sustainable rural development.

The infrastructure investments in rural areas are mired in hidden and explicit subsidies and heavy losses. The approach to investment in rural infrastructure was traditionally that of complete state support as such investment was viewed as economically unattractive and also too complicated for the private sector to consider. Most of these schemes require 25 percent contribution from states. Experience has shown that state governments are often slow in offering their share. In Kerala, the state government has taken a policy decision to transfer all small single village water supply schemes to gram panchayats. However, even with such a decision, the process has been slow and only a limited number of about 1000 such schemes have really been transferred. The state governments often give the availability of inadequate capacities of the local authorities to execute these programmes. There is a case for reform-linked incentives and assistance from the Centre to the States. Enactment of the 73<sup>rd</sup> Amendment developing a framework of user charges, to create space for private finance could form the basis for setting up these criteria. Most poverty alleviation schemes of the government have asset creation and infrastructure creation components. The allocation of Rs.1, 86,960 crore has been sanctioned for rural infrastructure, under the Bharat Nirman programme which is the single largest allocation for any sector and is 54 percent higher than the previous year.

The Jawahar Gram Samridhi Yojana scheme aimed for school buildings, rural roads and other infrastructure and Swarna Jayanti Swarozgar Yojana (SGSY) to support micro-enterprises. The Employment Assurance Scheme (EAS), Food for Work programmes and Mahatma Gandhi National Rural Employment Guarantee Programme (MNREGP) provide employment to villagers through construction of minor local infrastructural resources such as small roads, school buildings, and pond digging.

## 7. NEED FOR MODERNISATION OF RURAL INFRASTRUCTURAL RESOURCES TOWARDS SUSTAINABLE RURAL DEVELOPMENT

Rural development mainly depends on the existing infrastructural resources for all the sectors for social, economic and cultural development of rural masses. India has a wide range of infrastructural resources devoted to national development, in the form of road and transport, electricity, postal and telecommunication, education, health and sanitation, drinking water facilities, etc.. These facilities are essential in all the ways of life of the rural people and all their activities of farming, marketing and every aspect of day to

day life. The infrastructural resources in rural area are abundant in use and abused by majority of their users. Because they have been neglected and encroached by the users, the rural infrastructural resources are in disrepair and their services to the people are reduced. People are not serious about the development of rural infrastructural resources which resulted in instability in the sustainable use. Due to various factors influencing rural infrastructural resources for their inefficiency in functioning, there have been negative impacts on rural society such as reduction in agricultural production, rural marketing, inefficient use of rural roads and transport, drinking water scarcity, poor health facilities, low quality oriented education, less employment opportunities and lack of people's participation.

## 8. A PROPOSED MODEL FOR MODERNISATION OF RURAL INFRASTRUCTURAL RESOURCES TOWARDS SUSTAINABLE RURAL DEVELOPMENT IN INDIA

India has a wide range of infrastructural resources that devoted to nation's development, in the form of road and transport, electricity, postal and telecommunication, education, health and sanitation, drinking water facilities, etc. The infrastructural resources in villages are basic for development and also the motivation factor for all development and welfare activities in villages.

Sustainable Rural Development is ensured through the modernization of rural infrastructural resources. It may be called

$$\text{MoRIR} + \text{SMIR}_2 + \text{L}_2 \text{ P}_2 \longrightarrow \text{SRD} + \text{Cs} (\text{RSID} + \text{REcD} + \text{REnD} + \text{RCID})$$

where,

- MoRIR** – Modernization of Rural Infrastructural Resources  
**SMIR<sub>2</sub>** – Strategic Management of Infrastructure Resource in Rural Area  
**L<sub>2</sub> P<sub>2</sub>** – Local Level People's Participation  
**SRD** – Sustainable Rural Development  
**Cs** – Changes in

- **RSID** – Rural Societal Development
- **REcD** – Rural Economic Development
- **REnD** – Rural Environment Development
- **RCID** – Rural Cultural Development

Hence, it is noted that provision of adequate and quality infrastructure in rural area is necessary for increasing productivity and efficiency of agriculture in the form of improving the credit absorbing capacity, enhancing the productivity of crops and livestock, generating employment, increasing farmers' income, etc. and in the process, it makes a direct attack on minimizing the incidence of rural poverty.

## 9. CONCLUSION AND POLICY IMPLICATION

Rural development mainly depends on the management of existing infrastructural resources through good governance of village level organizations for the promotion of all existing sectors towards social, economic, cultural and environmental development of rural masses. India has a wide range of infrastructural resources devotes to national building process in the form of road and transport, electricity, postal and telecommunication, education, health and sanitation, drinking water facilities, etc. The infrastructural resources in villages are basic to the development and also the motivational factor for all development welfare activities in villages. Both central and state governments will take necessary steps to develop such rural infrastructural resources in order to provide all villages of our country with cent percent infrastructural resources. According to the planning commission's draft Twelfth Five Year Plan highlights the progress towards inclusiveness. Through the status analysis of rural infrastructural resources in India, it is concluded that the infrastructural resources in rural India is pivotal social, economic and environmental factor which determine the quality of rural livelihood, especially for a certain changes in socio-economic transformation of rural society on sustainable basis, through proper conservation of existing infrastructural resources in rural area and provision of basic resources like water, electricity, roads, sanitation and housing. It is suggested that the creation of national level platform for sustainable rural transformation in the major areas of rural infrastructural resources through local level people's participation is very much essential. Expansion of all infrastructural resources in villages is extremely important for the development of rural area in a sustainable manner. Further, the



time will come to provide cent percent of rural infrastructural resources through the instrument of both central and governments which will enable to promote sustainable rural development in the whole country.

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#### **Conflict of Interest:**

The authors declare that there are no conflicts of interests.

#### **Peer-review:**

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#### **Data and materials availability:**

All data associated with this study are present in the paper.

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